AD-A118 783 ERIE TECHNOLOGICAL PRODUCTS OF CANADA LTD TRENTON (O--ETC F/G 13/8
MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE--ETC(U)
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ELEVENTH AND TWELFTH
PROGRESS REPORT

ON

MANUFACTURING METHODS AND TECHNIQUES
FOR MINIATURE HIGH VOLTAGE HYBRID
MULTIPLIER MODULE

CONTRACT NO. DAAB07-76-C-0041

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

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2. GOVT ACCESSION NO: AD-A118 783
3. RECIPIENT'S CATALOG NUMBER:
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7. AUTHOR(s): M.I. MATUSZEWSKI
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9. PERFORMING ORGANIZATION NAME AND ADDRESS: Erie Technological Products of Canada, Limited, 5 Fraser Avenue, TRENTON, Ontario, Canada K8V 5S1
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High Voltage Multipliers, High Voltage Power Supplies, Night Vision, Second Generation Image Intensifier Tubes, High Voltage Rectifiers, Ceramic Capacitor Banks, Miniature Modules.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The assembly of a multiplier with a notched capacitor was evaluated. The thickness of the capacitor was maintained to ensure high breakdown voltage.

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UNCLASSIFIED

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ELEVENTH QUARTERLY PROGRESS REPORT

MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE HYBRID MULTIPLIER MODULES

CONTRACT NO. DAAB07 - 76 - C - 0041

PREPARED BY: M. I. MATUSZEWSKI, P.ENG.

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PURPOSE

This Contract covers component designs, mounting and interconnection techniques, tooling and test methods and other manufacturing methods and techniques required for production of rectangular and curved miniature high voltage multiplier modules. These units are to be used in low cost power supplies for image intensifier tubes. The full scope and details of the specification are given in Appendix A to the Eighth Quarterly Report.

Major milestones in this program consist of delivery of the following items:

(1) First and second engineering samples and test data.

(2) Production line layout and schedule.

(3) Confirmatory samples and test data.

(4) Production line set-up.

(5) Pilot production run.

(6) Production rate demonstration.

(7) Preparation and publication of a final report.

The general approach is to design and set-up a cost-effective production capability, utilizing already established device technologies and materials, and to demonstrate the production line capability to fabricate at the rate of 125 acceptable units per 40 hour week.

1. INTRODUCTION

This report describes briefly the progress in the Manufacturing Methods and Techniques for Miniature High Voltage Hybrid Multiplier Modules Program, made during the latest calendar year

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In the Third Quarterly Report results of electrical tests on rectangular multiplier modules were presented.

...1

For an input voltage of 1 KV, efficiencies above 96% under no-load conditions and above 95% with 500 nA load currents were achieved for all multipliers assembled with TSK 25-250 and TSK 25-251 and three-chip rectifiers. Low ripple voltages, input capacitances and charging currents were also measured on these multipliers. Results of the mechanical and electrical evaluation of TSK 25-249 curved capacitor banks were also presented in the Third Quarterly Report.

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In the Fifth Quarterly Report were presented the results of electrical performance testing at the room, high (+52°C) and low (-54°C) temperatures, as well as effects of thermal shock, and high and low temperature storage.

In the Sixth and Seventh Quarterly Reports were presented the results of testing of rectangular and curved multipliers to the Second Engineering Sample requirements,

...2

steps to improve the frequency performance of the multipliers and optimization of the rectifiers for these devices, as well as results of life testing of multipliers.

In the Eighth Quarterly Report the results of the reliability testing of rectangular and curved multipliers to the Second Engineering Sample requirements were analyzed and further steps to improve the performance of the multipliers and optimize the rectifiers for these devices were discussed.

In the Ninth Quarterly Report the results of further life testing of rectangular and curved multipliers was discussed. The commencement of the Confirmatory Sample phase was described including improvements in the manufacturing methods.

In the Tenth Quarterly Report a data was presented on material and fixtures used in the fabrication of the multiplier modules. The technique of silk screening the conductive epoxy onto the components is described in fabrication of the voltage multipliers.

FABRICATION AND EVALUATION OF MULTIPLIERS

During the first quarter of 1979 most of the work was devoted to manufacturing and assembling of the multiplier modules which were described in the Tenth Quarterly Report.

In January the vacuum fixture for molding parts for the silk-screening process has been built. Additional screens had been received from ERIE, PA.

However, when production started on the 10 curved multipliers, 7 were "open", 1 was "shorted" and the other 2 indicated a short of several rectifiers within the diode chain. In February, 11 pieces were assembled, 3 were good on V_F (forward voltage drop), 1 was good on V_O (optional test), 2 broke physically in assembly, 6 were "open" when tested on V_F.

At the time of writing this report, the reject units could not be located to do a reject analysis, but subsequent recommendations by previous program manager were requested and on file.

Most of the March was spent on the design and fabrication of fixtures and tooling for the assembly of capacitors to substrates and for the soldering of leads to capacitors. The Ceramic Engineering Group provided us with another 23 tapped capacitors. They have been informed of the problem of the oversize capacitors and they assured me to be able to supply capacitors that are 80° in arc.

In June 1979, it became obvious that we could not fabricate the parts on any production scale using previous method and design. A new assmebly technique was developed and is outlined below.

The same rectifiers were used as before, an additional epoxy roll-coat were given and leads were retained to assure good solder connections. The capacitor is notched to make room for a diode body.

The same thickness of ceramic is retained in order to maintain a sufficiently high voltage breakdown.

The modified assembly is illustrated in an isometric sketch TSF-31-[illegible]. The new method, as a simplification of original concept, should give cost saving in large scale production. With regards to the change, the following modifications were requested:

1) Part II Section H, Suppliers Schedule Date - The schedule to be changed to the following:

Item No. 0001AB - Confirmatory Sample

Delivery: 4 February 1980

Item No. 0001AC - Pilot Run

Delivery: 16 June 1980

Item No. B003 - Test Report of Confirmatory Samples

Delivery: 4 February 1980

Item No. C003 - Final Report

Delivery: Draft due 14 July 1980 (First distribution 30 days after approval.)

Item No. C004 - General Report, Step II

Delivery: 30 days after approval of First Report.

Item No. 0005AA - Rehability Testing

Delivery: 16 June 1980

2) Electronics Command Technical Requirements SCS-495.

a) On pages 20 and 21, para 2.1 on each page to be changed to following:

"2.1 D_i and D_o leads: 0.015 Diameter silver or tinned copper."

b) On pages 20 and 21, AC and GND leads to exit the package on the same face as the D_i lead (as illustrated in sketch TSK 312-112)

The schedule changes result from the delivery of the new capacitors by our vendor. The reason for request 2(a), is simple - we intend to use the diode's own lead for D_i and D_o and its diameter is .015". Regarding the change in lead positions, this is necessitated by the fact that the leads can no longer emerge from the sides as there would be too great a probability of breakdown from the leads to the diodes nearest them. Therefore, the only feasible alternative is the one suggested above and any testing on such parts must be performed in a dielectric fluid or after further encapsulating the entire multiplier.

CONCLUSION

Nearly every position within this contract has changed many times in 1976, 1977 and 1978. For example: the Procuring Contracting Officer at Fort Monmouth was changed 3 times, the Contracting Officer's Technical Representative 2 times, the Project Engineer at Fort Belvoir 3 times, the Representative for Canadian Commercial Corporation 3 times.

Finally, the ERIE Programme Manager was initially A. Kennedy, then Dr. M. Korwin Pawlowski (March 77), B. G. Gordon (September 1978) and as of January 1980 M. Matuszewski.

These changes have negative impact in continuation of the project as for delivery schedule. However, additional effort will be made by present Programme Manager to fulfill our commitments.

Program for first quarter of 1980:

4.1 Most attention must be placed to keep progress according to schedule.

4.2 Necessary changes in design to assure production assembly should be made. Present design proposition is not practical to mass assembly.

4.3 Initiate manufacture of the proper capacitors.

4.4 Design and fabricate tools and jigs.

4.5 Fabricate and test engineering sample.

PUBLICATIONS AND REPORTS

No reports or publications were made on the work associated with this program during the last year.

IDENTIFICATION OF PERSONNEL

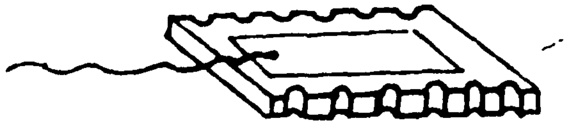
Brief descriptions of the background of technical personnel involved were included in the preceding Progress Reports. The following persons worked in their area of responsibility:

INDIVIDUAL	RESPONSIBILITY	HRS.
B. G. Gordon	Programme Manager	484
J. Pack	Manufacturing Personnel	366
R. Shah	Programme Manager	80
K. Cram	Draughtsman	13
V. Glenn	Q.C. Inspector	15
B. Heidt	Process Engineering Supervisor	112.1
P. Maples	Senior Engineering Technician	306.8
D. Regan	Senion Engineering Technician	48.5
F. Treverton	Senion Test Technician	1

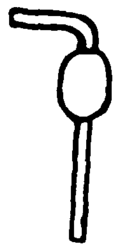
TOTAL HOURS	- in 1979	1441.4
TOTAL HOURS	- to date	6295.4

METHOD OF ASSEMBLY, AS USED ON THE PROTOTYPE DUMMY SAMPLES

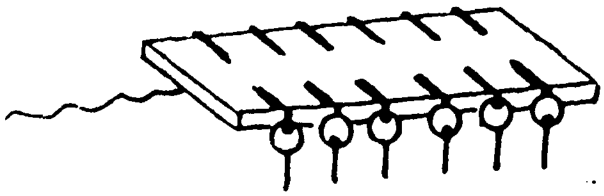
1. Solder input wire to common side of 2 capacitors.



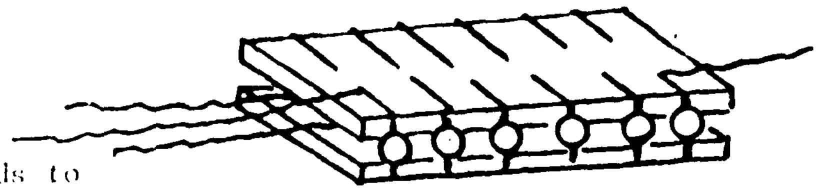
2. Pre-cut and bend 12 diodes (6 cathode to bend, 6 anode to bend.)



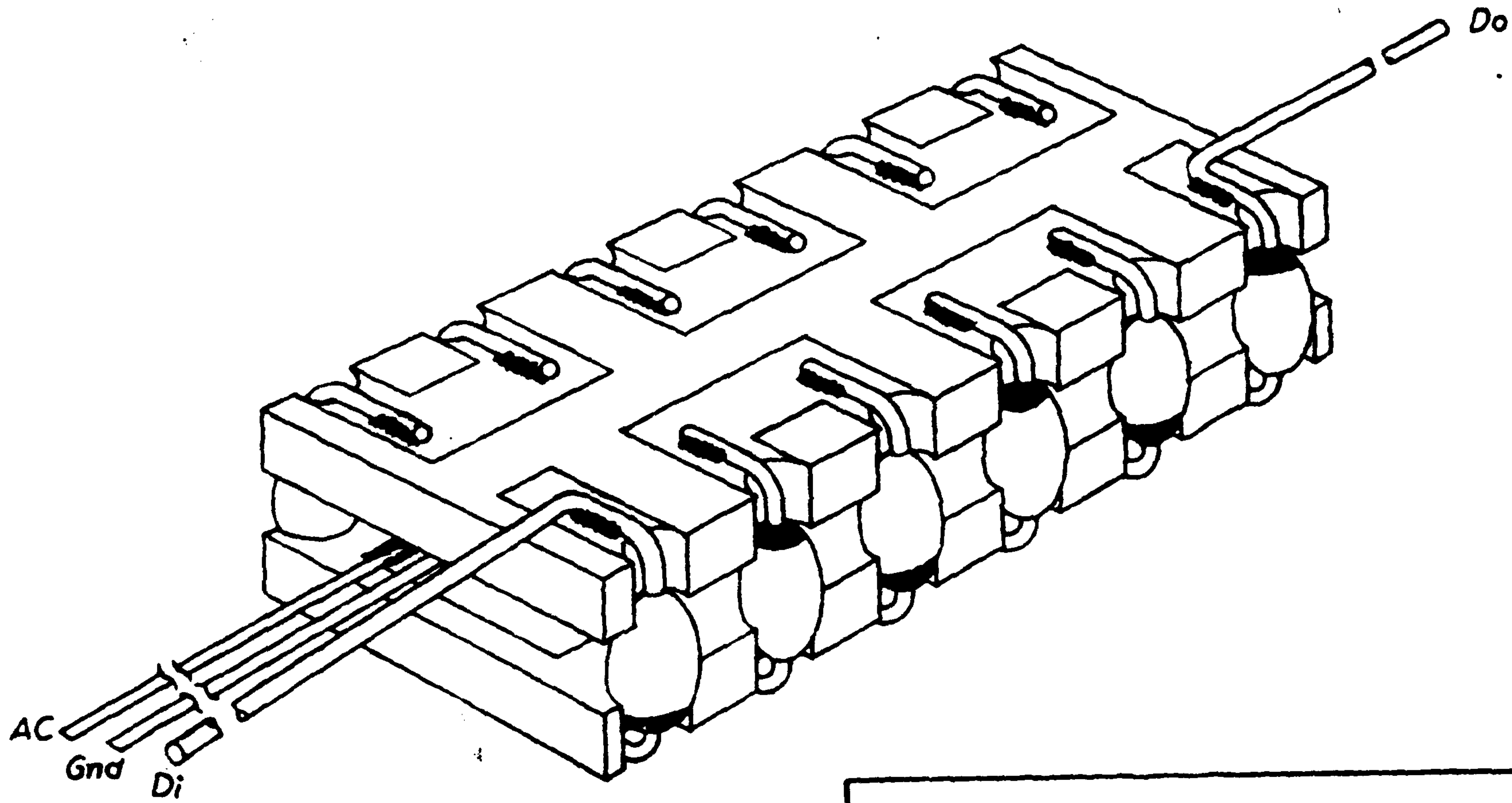
3. Solder 12 diodes to the first capacitor.



4. Locate second capacitor. Bend 12 Diode leads, solder to second capacitor



5. Solder 2 output leads to second capacitor.



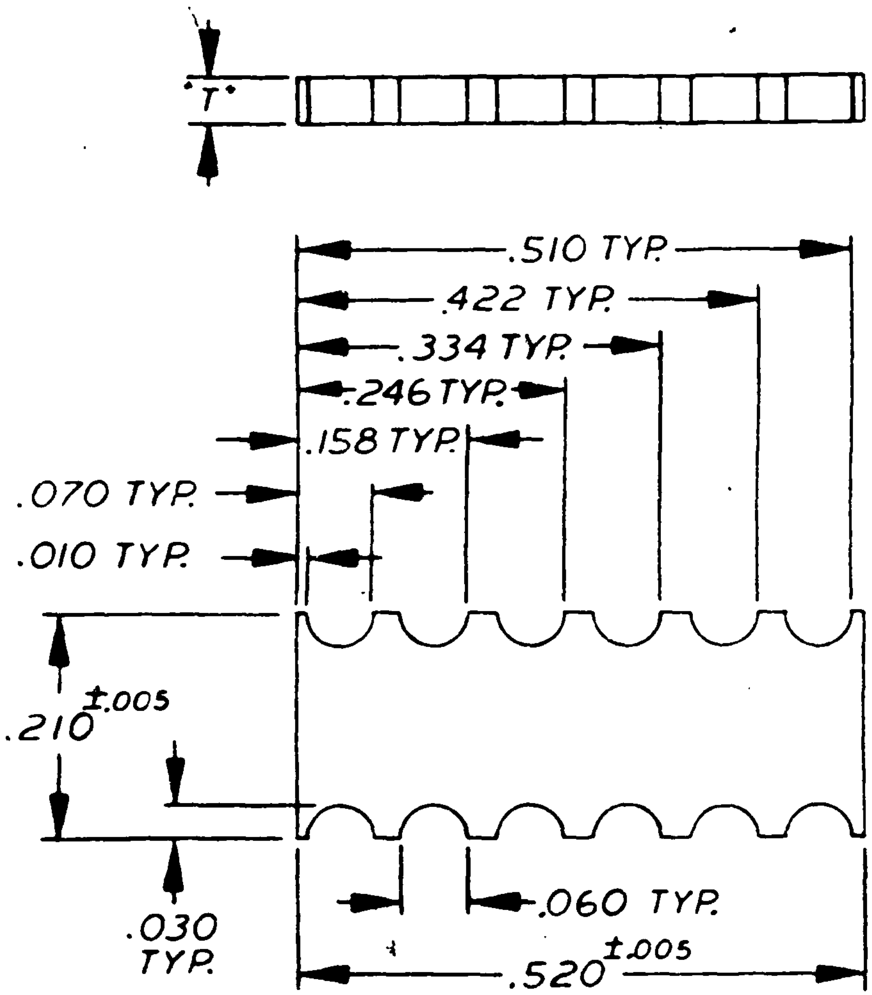
REGISTERED PROFESSIONAL ENGINEER
B. G. GORDON
PROVINCE OF ONTARIO

MULTIPLIER ASSEMBLY	
DWN. K. Chan 25 June 79	CKD. B.G.Gordon 29/VI/79
Erie Technological Products of Canada Ltd. Trenton, Ontario	SHT. 1 OF 1
	TSK-312-112

CSK-54003 REV

ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	±
ANGLES	±



ITEM	K BODY	THICKNESS "T"
-01	K1200	.040
-02	K1600	.050

SCALE: 6=1

REV NO

REVISIONS

NOT CONTROLLED

CAPACITOR BLANK

DRAWN BY K. Cran FEB. 11/80

CHECKED BY [illegible]

DATE FEB. 11/80

MATERIAL CERAMIC

FINISH ______

Erie Technological Products Limited
Trenton, Ontario

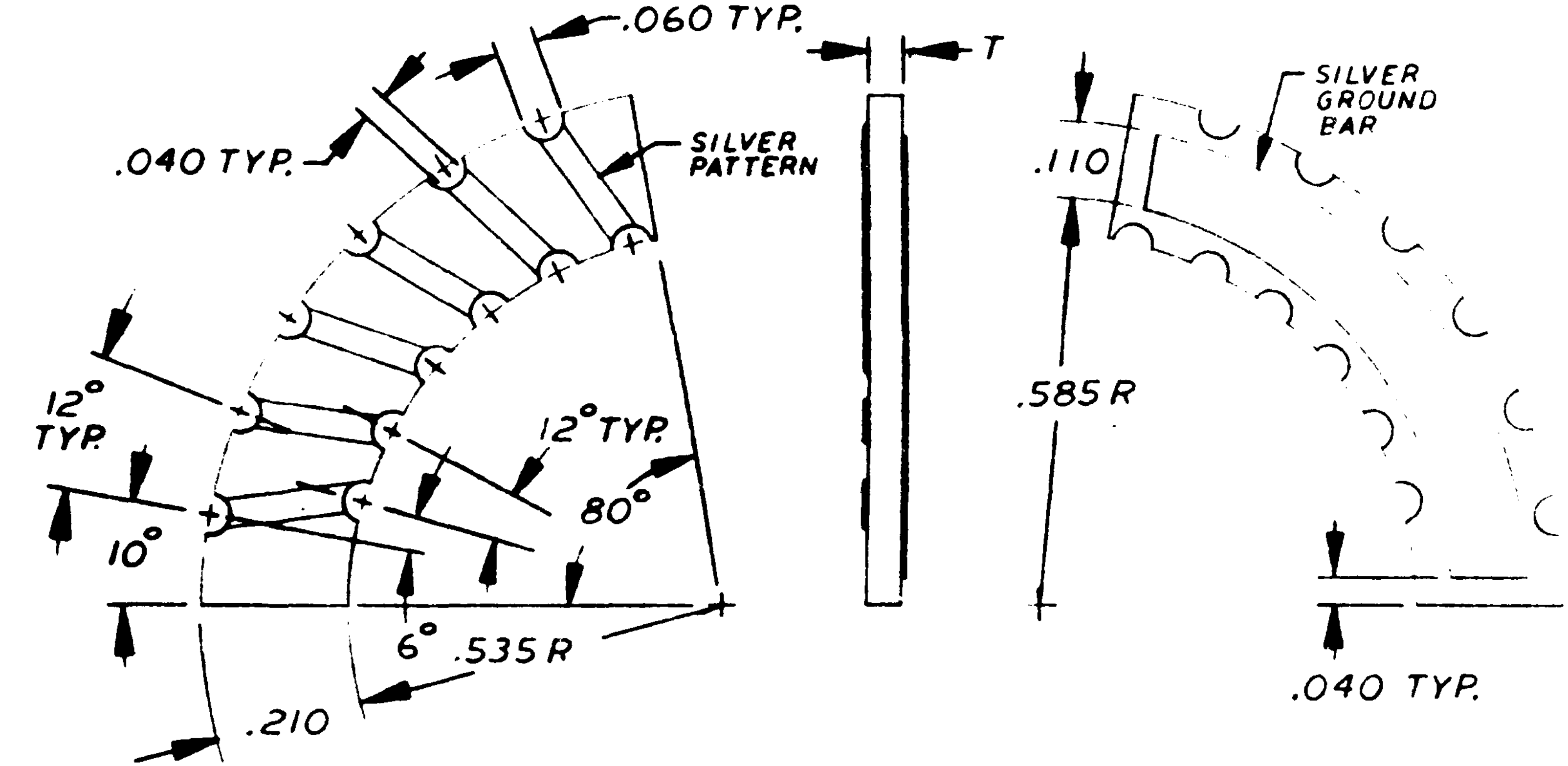
CSK-54003 REV

CSK54002 | REV

ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLE BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES DO NOT SCALE THIS DWG

ITEM	K BODY	THICKNESS "T"
-01	K1200	
-02	K1600	

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	± ———
DECIMAL	± .005
ANGLES	± 1°



SCALE: 4 = 1

ADVANCE COPY NOT CONTROLLED

REV NO | REVISIONS

PLANAR CAPACITOR

DRAWN BY L. Crane Feb. 1980	MATERIAL ———
CHECKED BY	FINISH ———
DATE	
Erie Technological Products Limited, Trenton, Ontario	CSK54002 REV

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5 Fraser Avenue
TRENTON, Ontario, Canada K8V 5S1

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The problems associated with the assembly of multipliers and diode designs have been discussed. Some electrical measurements have been presented and recommendations made to reoptimise capacitor and diode.

TWELFTH QUARTERLY REPORT

QUARTERLY PROGRESS REPORT

THIRD QUARTER 1981

MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE HYBRID MULTIPLIER MODULES

CONTRACT NO. DAAB07 - 76 - C - 0041

PREPARED BY: K.I. SEMY

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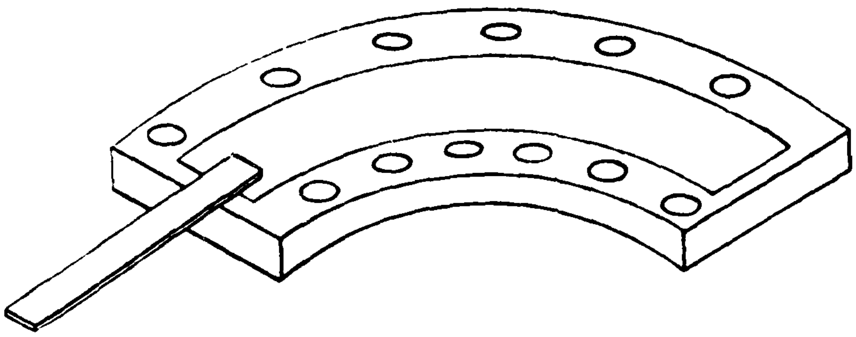
In the Tenth Quarterly Report a data was presented on material and fixtures used in the fabrication of the multiplier modules. The technique of silk screening the conductive epoxy onto the components is described in fabrication of the voltage multipliers.

In the Eleventh Report, fabrication and evaluation of the multiplier was discussed with notched capacitors and P-package diodes from Murata Erie North America, Inc.

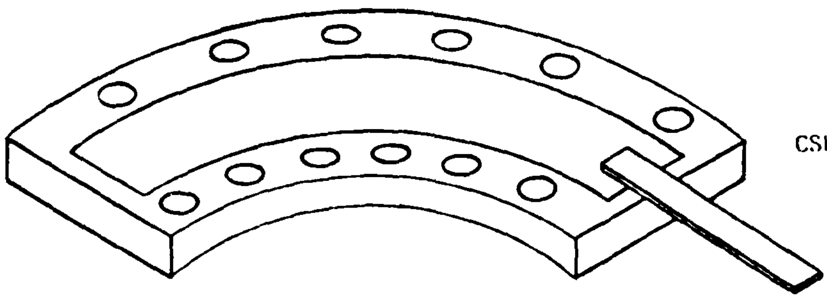
ASSEMBLY OF MULTIPLIER (MIREK MATUZEWSKI PROCESS)

1. Dip silvered ceramic capacitors into 60% lead 40% tin solder solution.

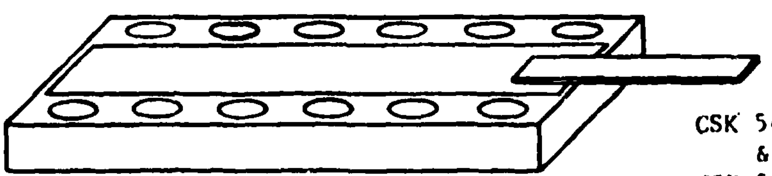
2. Solder silver strip to the ground pattern on ceramic as shown on figure 1.



CSK 54025



CSK 54021

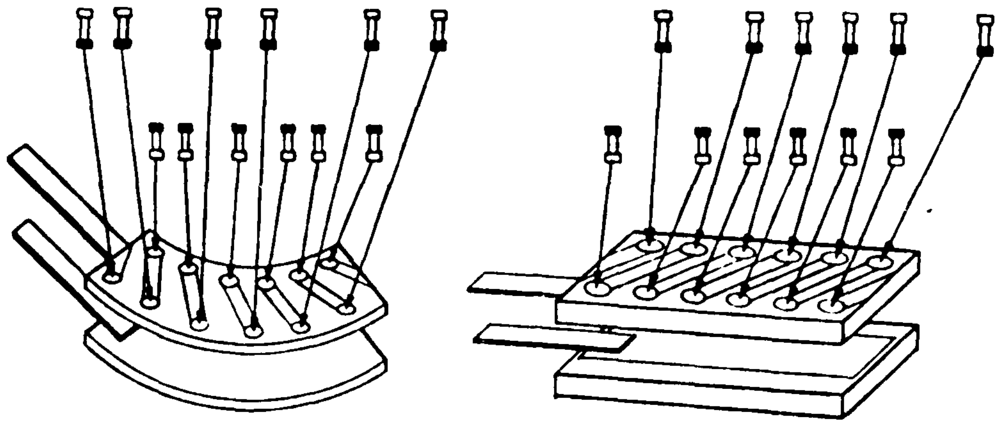


CSK 54019
&
CSK 54020

Fig. 1 Position of "ground" terminals.

3. Place capacitors in the assembly fixture.

4. Locate diodes in holes in ceramic capacitors with the orientation as shown on figure 2a and 2b



(a) (b)

Fig. 2. Diode assembly module. a) TSK 313-113 module b) TSK 312-114

5. Apply flux and solder to create bridges between ceramic silvered pattern and diodes.

6. Attach silver lead terminals to the input and output of the multiplier.

7. Etch devices for 1 minute, clean in ultrasonic and D.I. water.

8. Dip devices into varnish and cure in 160°C for 24 hours.

9. Place device in the rubber mold and fill it with epoxy coating.

10. Cure epoxy in 160°C for 12 hours.

11. Remove multiplier from rubber mould.

PROBLEMS

1. Extensive cracking of the capacitor during solder dipping operation.

2. The surface damage on the diodes caused by the sawing of the stack was removed after assembly of the multiplier. Assuming 90% test yield on the diode, the overall yield to complete multipliers would be very small as one diode in any 12 diodes used in the multiplier could reject the complete multiplier assembly.

3. During the soldering operation it is difficult to control the size, as a solder bridge had to be formed between the diode and the silver of the ceramic with the solder. This could only be achieved by using large amount of solder. Hence the overall thickness of the multiplier was typically 0-200" to 0-220". The diode had to be subsequently lapped down to size which resulted in some yield loss.

4. The hand soldering operation gives us limited output.

After the departure of Mirek Matuszewski the project responsibilities were assumed by the writer, and therefore actions were taken to modify the process.

The following process changes were made:

1. The diodes used for assembly were etched, varnished, epoxy coated and 100% tested before assembly of multiplier.

2. The overall diameter of the diode had to be maintained to be less than diameter of the hole in the ceramic capacitors. In December 1980, we started soldering multipliers and after eliminating assembly rejects we produced approximately 33 pcs. of TSK 312-000 and 30 pcs of TSK 313-000 to meet the confirmatory sample requirements.

RESULTS:

The multipliers were tested for Gr. 1 test and results are as below.

	No. of Pieces to Test	Good Pieces	Charging Current reject	Efficiency Reject
TSK 312-00	30	20	6	6
TSK 313-00	30	16	7	7

Yield on test	TSK 312-00	60.6%
	TSK 313-00	53.3%

The multipliers passing test were showing charging current of 200 to 250 microamps. It was therefore decided to initiate further optimisation of the diode and the capacitor. (Test results pg. 11)

Test •

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SHEET • 1 OF I — QUALITY CONTROL DEPT. - RECORDED DATA SHEET

NOTES • PAGE:

FILE NO ___

P.O. DAAB07-76-C-0041

TEST Fort Monmouth Confirmatory Testing (Group I)

PART TSK 312 (6 stage Rectangular Mult. Module

SPECIAL DETAILS Re Spec. No: SCS-495

F.O.

QTY

Start Date

TEST DATE:

TEST COND:

PARAMETER	Multiplier Efficiency Calculation					CHG. Current	Input Cap.
INPUT VOLT	1000 Vp/p @ 35 KHz sine wave				Δ EFF.	1000 Vp/p	1000 Vp/p
LOAD CURRENT	<2nA	<2nA	500nA	500nA	2nA-500nA	<2nA	<2nA
SPEC. PARA.	Output Volt.	3.2.1.1	Output Volt	3.2.1.1		3.2.1.3	3.2.1.2
UNITS	KVdc	%	KVdc	%	%	μA	pF
REQUIREMENT		94% min			Δ 2% max.	250μA max.	8pF max.

Identification Number							
Red # 1	5.710	95.2	5.680	94.7	0.5	260	5.89
# 2	5.760	96.0	5.730	95.5	0.5	220	5.04
# 3	5.740	95.7	5.710	95.2	0.5	220	5.00
# 4	5.560	92.7	5.510	91.8	0.9	220	5.31
# 5	5.740	95.7	5.710	95.2	0.5	220	5.55
# 6	5.360	89.3	5.160	86.0	3.3	190	5.41
# 7	5.720	95.3	5.690	94.8	0.5	220	5.16
# 8	5.750	95.8	5.720	95.3	0.5	220	4.76
# 9	5.410	90.2	5.310	88.5	0.3	230	4.95
# 10	5.410	90.2	5.340	89.0	1.2	260	5.46
# 11	5.460	91.0	5.440	90.7	0.3	130	4.22
# 12	5.580	93.0	5.560	92.7	0.3	310	5.06
# 13	5.740	95.7	5.710	95.2	0.5	250	5.24
# 14	5.740	95.7	5.710	95.2	0.5	240	5.15
# 15	5.700	95.0	5.670	94.5	0.5	280	5.27
# 16	5.710	95.2	5.690	94.8	0.4	350	5.18
# 17	5.710	95.2	5.680	94.7	0.5	300	5.77
# 18	5.700	95.0	5.680	94.7	0.3	250	5.27
# 19	5.750	95.8	5.720	95.3	0.5	130	5.44
# 20	5.740	95.7	5.710	95.2	0.5	220	5.44
# 21	5.690	94.8	5.660	94.3	0.5	250	6.16
# 22	5.700	95.0	5.670	94.5	0.5	220	5.29
# 23	5.750	95.8	5.730	95.5	0.3	250	5.32
# 24	5.740	95.7	5.710	95.2	0.5	260	6.15
# 25	5.540	92.3	5.522	92.0	0.3	230	5.00
# 26	5.690	94.8	5.670	94.5	0.3	220	5.44
# 27	5.740	95.7	5.720	95.3	0.4	220	5.25
# 28	5.740	95.7	5.710	95.2	0.5	200	5.10

Test

ERIE TECHNOLOGICAL PRODUCTS
OF CANADA LTD

SHEET 1 OF I

QUALITY CONTROL DEPT. – RECORDED DATA SHEET

NOTES: PAGE:

PO DAAB07-76-C-0041

TEST FORT MONMOUTH CONFIRMATORY TESTING (GROUP I)

PART TSK-312 (6 STAGE Rectangular Mult Module

SPECIAL DETAILS RE SPEC. No. SCS-495

QTY

TEST DATE:

TEST COND.:

PARAMETER	MULTIPLIER EFFICIENCY CALCULATION					> CHG CURRENT	INPUT CAP.
INPUT VOLT	1000 Vp/p @ 35 KHz SINE WAVE				ΔEFF.	1000 Vp/p	1000 Vp/p
LOAD CURRENT	<2nA	<2nA	500nA	500nA	2nA-500nA	<2nA	<2nA
SPEC PARA	OUTPUT VOLT.	3.2.1.1	OUTPUT VOLT	3.2.1.1		3.2.1.3	3.2.1.2
UNITS	KVdc	%	KVdc	%	%	pA	pF
REQUIREMENT		94.0 min			Δ 2% max	250pA max	8pF max
RED # 29	5.730	95.5	5.700	95.0	0.5	260	5.10
# 30	5.720	95.3	5.690	94.8	0.5	220	5.31
# 31	5.710	95.1	5.690	94.8	0.3	250	5.33
# 32	5.710	95.1	5.690	94.8	0.3	220	5.26
# 33	5.720	95.3	5.690	94.8	0.5	240	5.31

IDENTIFICATION NUMBER:

ERIE TECHNOLOGICAL PRODUCTS
OF CANADA LTD

Test #

SHEET # 1 OF I

QUALITY CONTROL DEPT. – RECORDED DATA SHEET

FILE NO.

NOTES # PAGE:

P.O. DAAB07-76-C-0041

F.O.

QTY

TEST Fort Monmouth Confirmatory Testing (Group I)

PART TSK-313 (6 Stage - Curved Mult Module

SPECIAL DETAILS RE Spec. No. SCS-495

Start Date
Finish Date
Tested By
Approved By

TEST DATE							
TEST COND.							
PARAMETER	Multiplier Efficiency Calculation					▸ CHG CURRENT	INPUT CAP.
INPUT VOLT	1000 Vp/p @ 35 KHz sine wave				Δ EFF.	1000 Vp/p	1000 Vp/p
LOAD CURRENT	<2nA	<2nA	500nA	500nA	2nA-500nA	<2nA	<2nA
SPEC. PARA.	OUTPUT VOLT	3.2.1.1	OUTPUT VOLT	3.2.1.1		3.2.1.3	3.2.1.2
UNITS	KVdc	%	KVdc	%	%	μA	pF
REQUIREMENT		94% min.			Δ 2% max.	250μA max.	8 pF max.
Block							
#1	5.750	95.8	5.740	95.7	0.1	240	6.65
#2	4.360	72.7	3.960	67.7	9.2	200	6.14
#3	5.710	95.2	5.680	94.7	0.5	200	6.34
#4	5.740	95.7	5.720	95.3	0.4	350	6.28
#5	5.730	95.5	5.710	95.2	0.3	220	7.13
#6	5.710	95.2	5.690	94.8	0.4	200	6.17
#7	5.740	95.7	5.720	95.3	0.4	230	7.10
#8	5.740	95.7	5.710	95.2	0.5	380	6.43
#9	5.710	95.2	5.690	94.8	0.4	250	6.18
#10	ARCING	–	–	–	–	–	–
#11	5.740	95.7	5.720	95.3	0.4	180	6.63
#12	5.360	89.3	4.860	81.0	8.3	160	6.33
#13	5.310	83.5	5.260	87.7	0.8	200	5.47
#14	5.740	95.7	5.710	95.2	0.5	220	6.24
#15	5.410	90.2	5.630	89.3	0.9	130	6.35
#16	5.730	95.5	5.700	95.0	0.5	230	6.53
#17	5.740	95.7	5.710	95.2	0.5	220	6.48
#18	5.710	95.2	5.690	94.8	0.4	200	6.50
#19	5.740	95.7	5.720	95.3	0.4	400	6.36
#20	5.740	95.7	5.710	95.2	0.5	340	6.44
#21	5.740	95.7	5.730	95.3	0.4	220	6.76
#22	5.210	86.8	5.200	86.7	0.1	180	5.77
#23	5.720	95.3	5.700	95.0	0.3	220	7.00
#24	5.730	95.5	5.700	95.0	0.5	350	6.48

IDENTIFICATION NUMBER

ERIE TECHNOLOGICAL PRODUCTS
OF CANADA LTD

QUALITY CONTROL DEP'T. - RECORDED DATA SHEET

Test #

SHEET # 1 OF I

FILE NO

NOTES # PAGE:

P.O. DAAB07-76-C-0041

TEST Fort Monmouth Confirmatory Testing (Group I)

F.O.

PART TSK-913 (6 Stage Curved Mult. Module

QTY

SPECIAL DETAILS Re Spec. No. SCS-495

Start Date

Finish Date

Tested By

Approved By

Test Date:							
Test Cond.:							
Parameter:	Multiplier Efficiency Calculation					Chg. Current	Input Cap.
Input Volt:	1000 Vp/p @ 35 KHz Sine Wave				Δ Eff.	1000 Vp/p	1000 Vp/p
Load Current:	<2nA	<2nA	500nA	500nA	2nA-500nA	<2nA	<2nA
Spec. Para.:	Output Volt.	3.2.1.1	Output Volt	3.2.1.1		3.2.1.3	3.2.1.2
Units:	KVdc	%	KVdc	%	%	μA	pF
Requirement:		94% min.			Δ 2% max.	250μA max.	8pF max.
Block #25	5.740	95.7	5.720	95.3	0.4	330	6.93
#26	5.720	95.3	5.690	94.8	0.5	320	6.66
#27	5.790	94.3	5.670	94.5	0.3	350	6.63
#28	5490	91.5	5.470	91.2	0.3	250	6.24
#29	5.710	95.2	5.680	94.7	0.5	450	5.80
#30	5.730	95.5	5.710	95.5	0.3	240	6.42

Identification Number

PLANS

1. Evaluate reduced capacitance.
2. Decrease reverse recovery time of diode.
3. Improve assembly process, automate soldering to increase throughput and yield.

CONCLUSION:

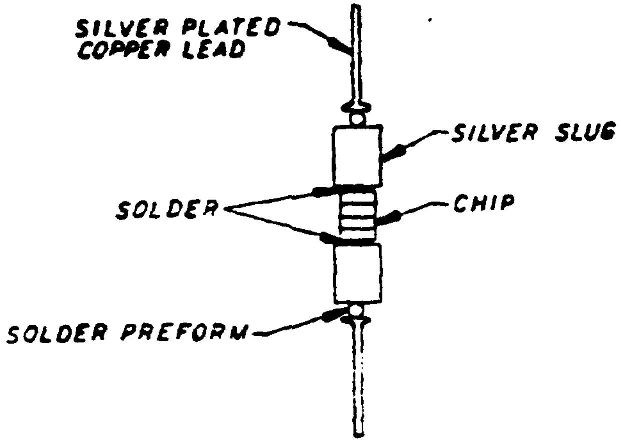
As reported in the eleventh quarterly report every position in the contract has changed many times. We have to report once again that Mirek Matuszewski who has been the Program Manager since January, 1980 left the company and his project responsibilities have been taken over by the writer. We are making a concentrated effort to complete this project and have also recruited one full time operator for fabrication of confirmatory samples and pilot production run.

We have requested for a change in schedule for delivery of samples and it shall be reported in my next quarterly report.

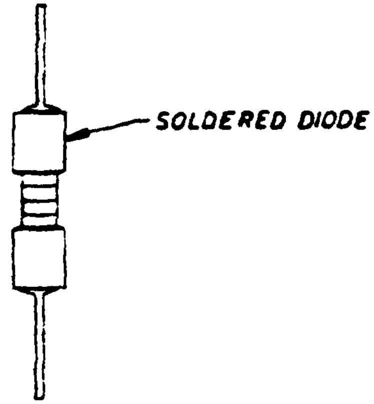
PUTLICATION & REPORT

No publications and reports have been issued in this quarter.

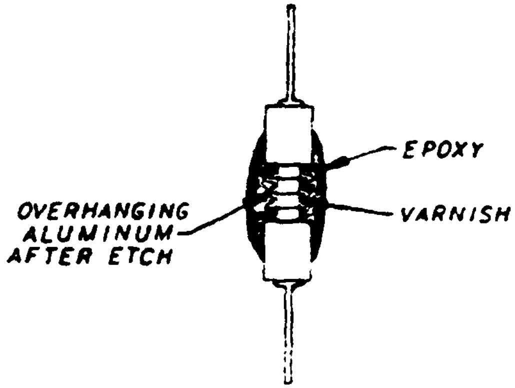
STEP 1
ASSEMBLY IN JIG



STEP 2
FURNACE SOLDERING IN ASSEMBLY JIG



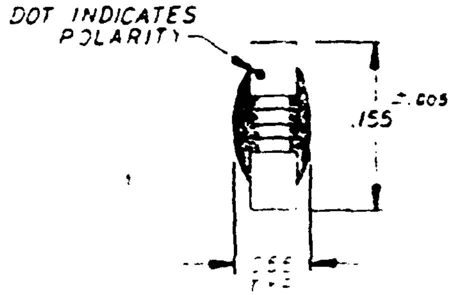
STEP 3
DIODE ETCHED, VARNISHED, + EPOXY COATED



STEP 4
DIODES ARE THEN TESTED FOR:

1. POLARITY
2. FORWARD VOLTAGE DROP @ 10mA. MAX 5-0V.
3. REVERSE LEAKEAGE @ 25°C. + 1KV, 100mA MAX.
4. REVERSE RECOVERY TIME; IF=2mA, IR=2mA, 200 NANOSECONDS MAX.

STEP 5



1. LEADS CUT OFF TO EXPOSE SILVER SLUG ON BOTH SIDES.
2. DIODE READY FOR ASSEMBLY.

CSK-54019 | REV

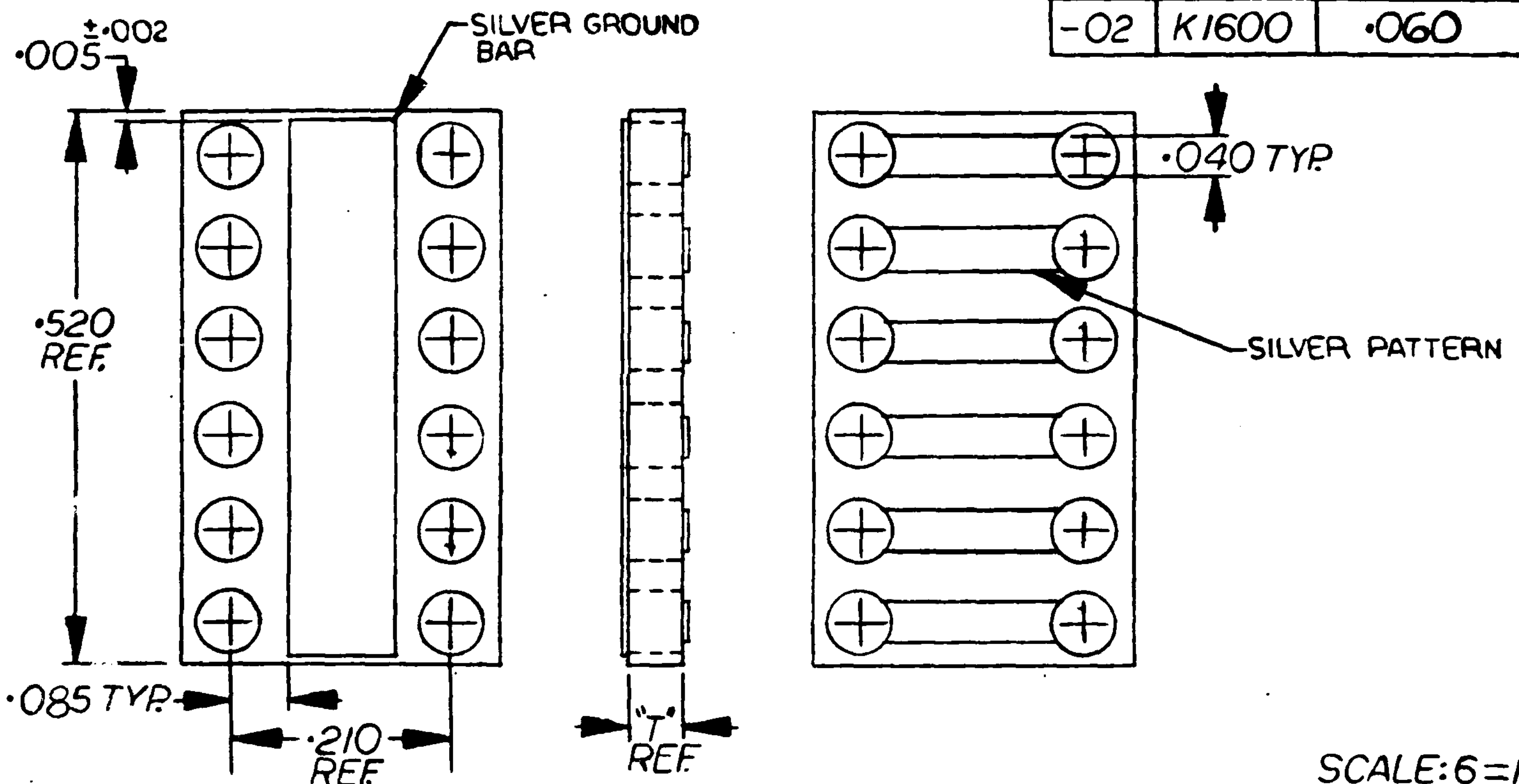
ACCEPTANCE OF MATERIAL SUBJECT TO A..ROVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	±.005
ANGLES	±

Cx: 50/75 pF PER SECT.
FLASH · 8 KVOLTS PER SECTION.

NOTES
1) REFER TO: T147-028, T147-027 SCREEN PATTERN
2) MAKE FROM CSK-54018

ITEM	K BODY	THICKNESS "T"
-01	K1200	.060
-02	K1600	.060



SCALE: 6=1

REV NO	REVISIONS
1	CHG. DIM. .0... TO .085 T.S. 26 FEB. 81
2	C.O. # 8128 2 JULY 81.
3	CO # 7953 4 AUG/81
4	CO 9058 30 DEC 81
5	C.O. # 9407 3 MAR. 82

NOT CONTROLLED

CAPACITOR

DRAWN BY	BONNY LANE	MATERIAL	CERAMIC
CHECKED BY	[illegible signature] 3/04/80	FINISH	
DATE	APRIL 3/80		

Erie Technological Products Limited | CSK-54019 | REV.

CSK-54020 | REV

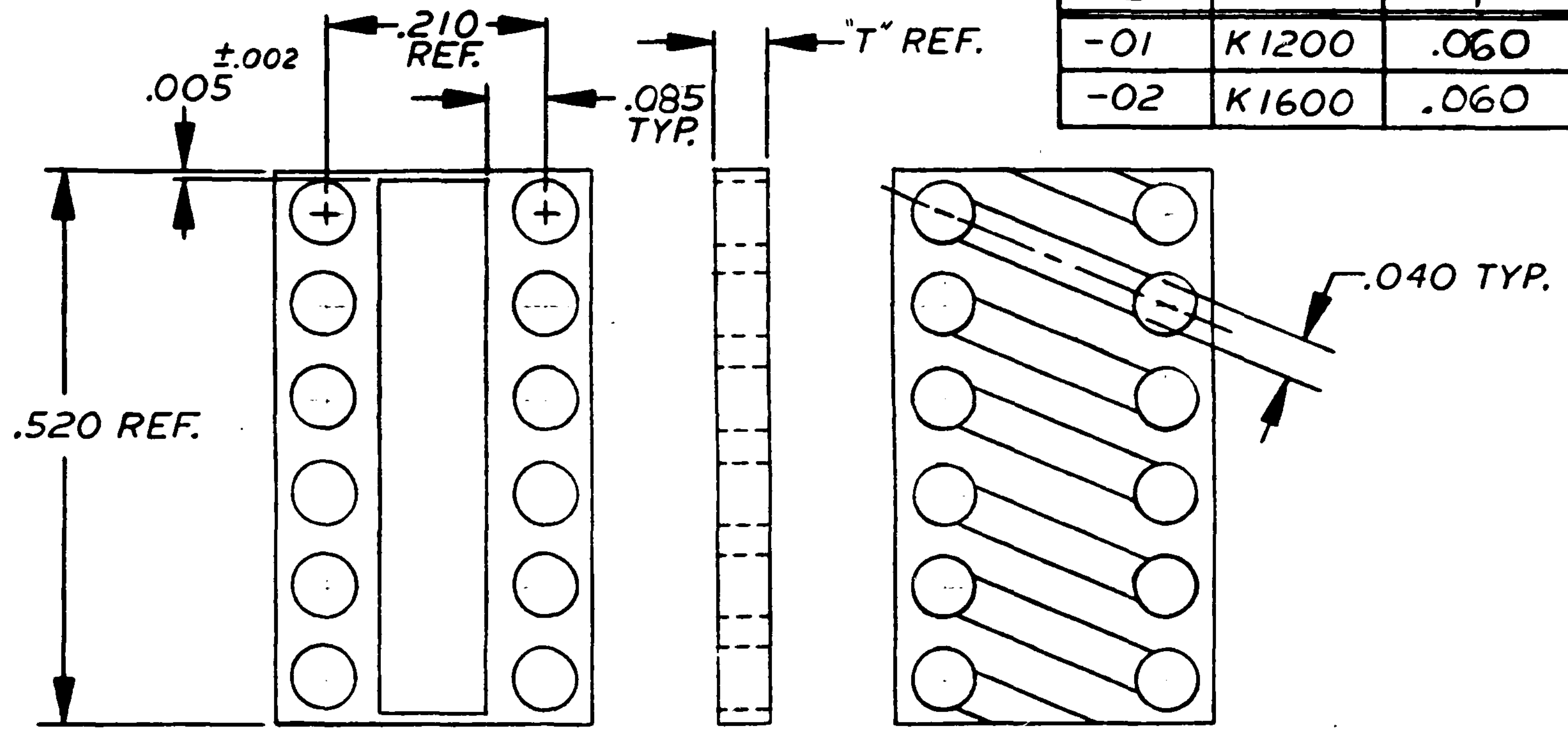
ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	±.005
ANGLES	±

Cx : 50/75 pF PER SECT.
FLASH: 8 K-VOLTS PER SECTION

NOTES
1) REFER TO T147 029, T147 027 SCREEN PATTERN
2) MAKE FROM CSK-54018
3) END SECTION TO HAVE A CX OF 25/40 pF EACH.

ITEM	K BODY	THICKNESS "T"
-01	K1200	.060
-02	K1600	.060



SCALE: 6=1

REVISIONS	REV NO
CHS DIM .055 TO .085 ... FEB 81	1
C.O. # 8128 2 JULY 81.	2
C.O.# 7953 4 AUG/81	3
CO 9057 29 DEC 81	4
CO 9408 1 APR 82	5

NOT CONTROLLED

CAPACITOR

DRAWN BY R. Cram APR. 8/80	MATERIAL	NOTE 2
CHECKED BY [signature] 8/04/80	FINISH	
DATE		
Erie Technological Products Limited	CSK-54020	REV

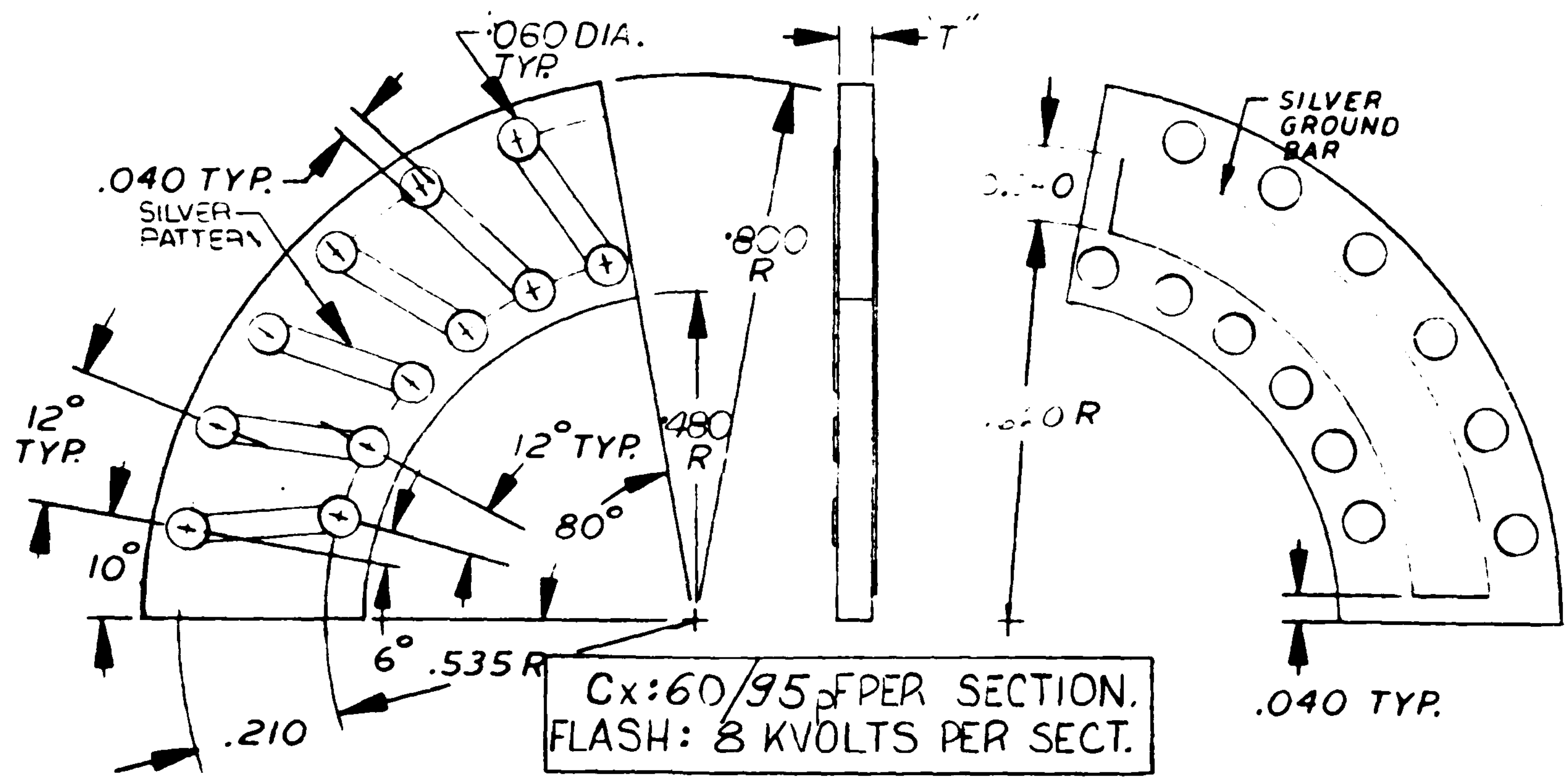
CSK54021 REV. A

ACCEPTANCE OF MATERIAL SUBJECT TO ... OVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES DO NOT SCALE THIS DWG

ITEM	K BODY	THICKNESS "T"
-01	K1200	.055
-02	K1600	.055

NOTES
1) REFER TO: T147023 SHT. #2, T147030 SCREEN PATTERN.
2) SILVER FROM CSK-54072

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	± —
DECIMAL	± .005
ANGLES	± 1°



SCALE: 4=1

REVISIONS	REV NO
B. LANE APR. 9/80	A
CHG. WIDTH OF SILVER GROUND BAR 0.110 TO 0.040 T.S. -26 FEB. 81	2
C.O. # 8128 2 JULY 81	3
CO 9059 30 DEC 81	4
CO 9411 1 APR 82	5
CO# 9612 11 MAY 82	6

NOT CONTROLLED

PLANAR CAPACITOR

DRAWN BY BONNY LANE
CHECKED BY [illegible] 3.03.80
DATE APRIL 2/80
MATERIAL —
FINISH —
Erie Technological Products Limited
CSK54021

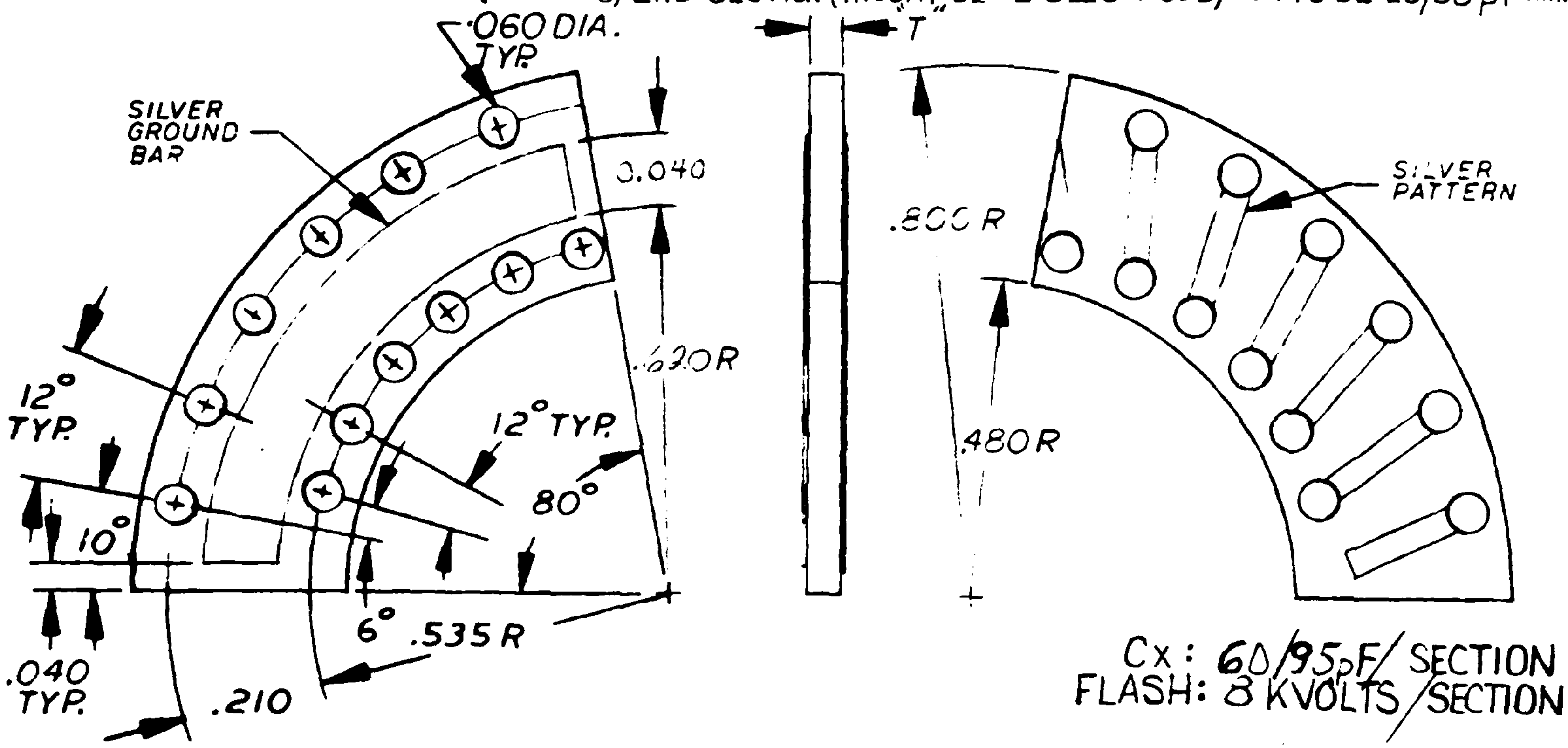
CSK54025 | REV

ACCEPTANCE OF MATERIAL SUBJECT TO ... OVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES · DO NOT SCALE THIS DWG

ITEM	K BODY	THICKNESS "T"
-01	K1200	.055
-02	K1600	.055

NOTES
1) REFER TO: T147023 SHT. #2, T147030 SCREEN PATTERN.
2) SILVER FROM CSK-54072
3) END SECTION (INCOMPLETE ELECTRODE) - CX TO BE 25/50 pF min

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	± ——
DECIMAL	± .005
ANGLES	± 1°



Cx: 60/95 pF/SECTION
FLASH: 8 KVOLTS/SECTION

SCALE: 4=1

REVISIONS	REV. NO
...G WIDTH OF SILVER ...UND BAR 0.110 TO ...040 / S. 26 FEB. 81	1
O. # 8128 / 2 JULY 81.	2
O. 9060 / 8 DEC 81	3
D 9412 / APR 82	4
D# 9013 / LNA ...	5

NOT CONTROLLED

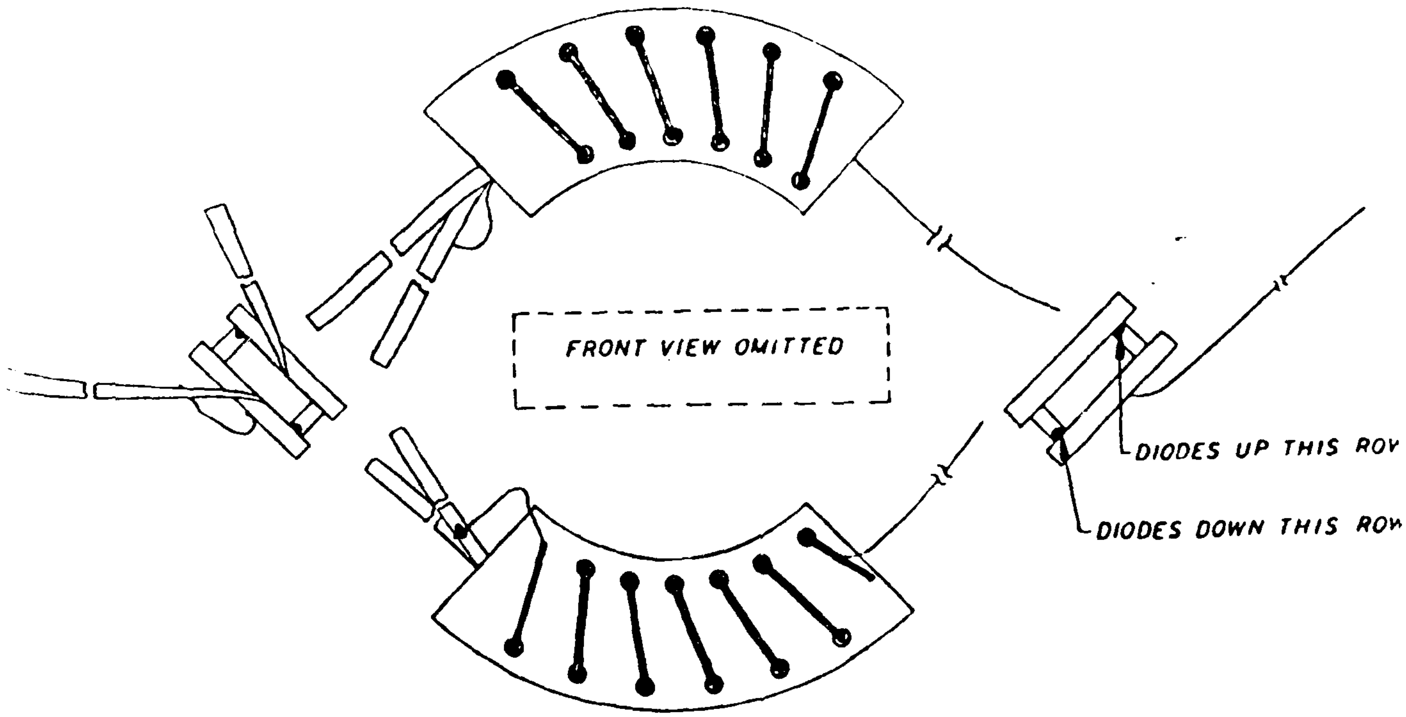
PLANAR CAPACITOR

DRAWN BY	... APR. 30/80	MATERIAL	——
CHECKED BY	...	FINISH	——
DATE	APRIL 30 1980		

Erie Technological Products Limited | CSK54025

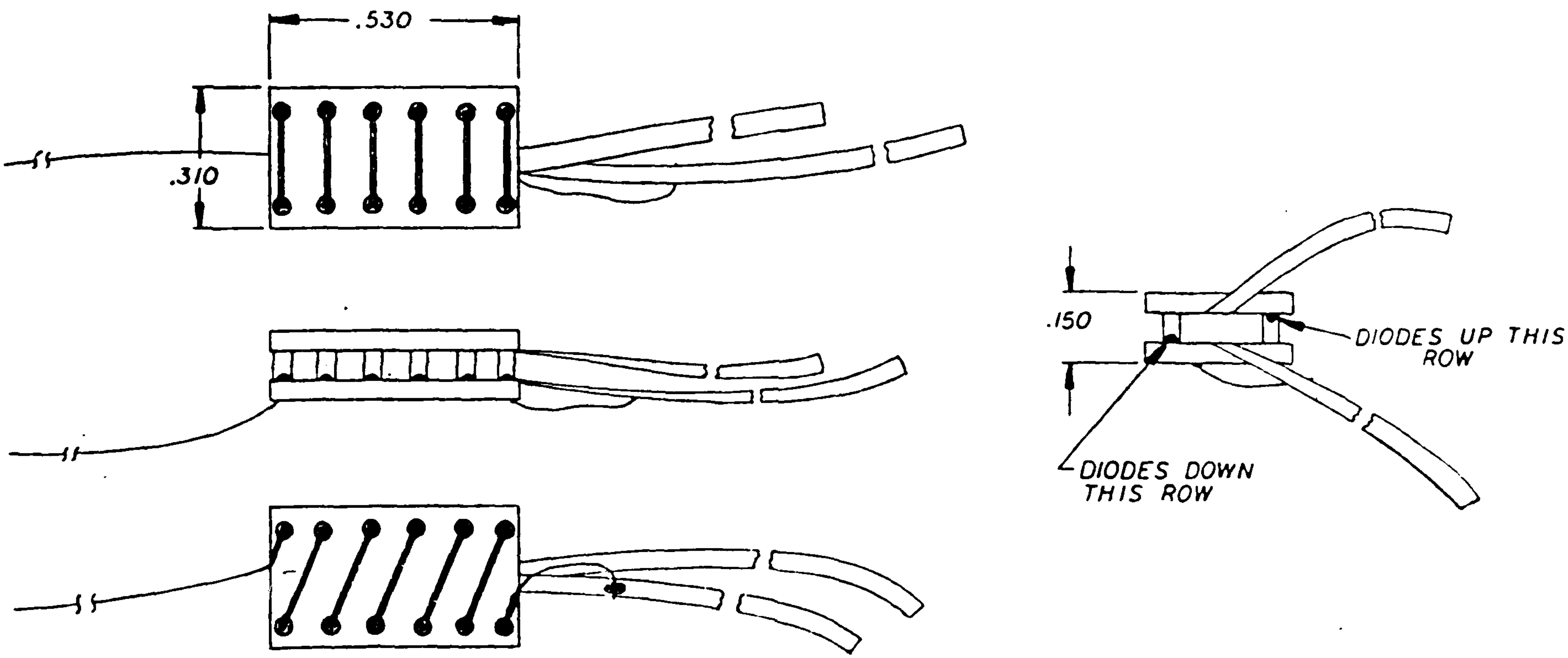
ASSEMBLED MULITPLIER

TSK 313-00



ASSEMBLED MULTIPLIER

TSK 312-00



DATE
ILME